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Contrast Sensitivity and Macular Thickness in Patients with Diabetic Macular Odema Following Grid Laser Photocoagulation

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Abstract: ***Aim: To assess the improvement in contrast sensitivity with Pelli Robson chart after grid laser. To quantify macular thickness by OCT. To assess the improvement in visual acuity with ETDRS chart after grid laser. Materials and methodology: This study was conducted at Department of Ophthalmology, Chalmeda Ananda Rao Institute Of Medical Sciences from June 2019 to June2020.100 Eyes of 50 patients fulfilling the inclusion and exclusion criteria were included in the study. All patients were subjected to detailed systemic and ophthalmic evaluation. Relevant systemic investigations like FBS, PPBS, BP Sr. Cholesterol, Sr.creatinine, Complete Blood Picture were done. Inclusion Criteria: Patients with Non-Proliferative Diabetic Retinopathy with Clinically significant macular oedema (CSME), Visual acuity 6/24 or better. Exclusion Criteria: Pseudophakia, Age related macular degeneration, Glaucoma, Proliferative diabetic retinopathy, Post pan retinal photocoagulation, Ischemic maculopathy. Results: Out of 100 Eyes in 50 patients Post treatment all patients had macular thickness less than 350 microns. There was improvement in Contrast Sensitivityin 90 eyes in the treated eyes, whereas 10 eyes did not show any improvement. There are 66% showing 5 letters improvement, 20% showing 5 letters improvement, 4% showing 15 letters improvement after 12 weeks of grid laser. Conclusion: Contrast sensitivity is an important aspect of visual function and is even more important for ordinary daily tasks than visual acuity. Loss of Contrast sensitivity is more important and disturbing for the patient than is the loss of visual acuity Visual acuity was recorded by ETDRS chart due to the fallacies associated in Snellen chart. The Contrast sensitivity was recorded by Pelli Robson's chart was sensitive and reproducible. Grid laser photocoagulation in CSME helps in improving the contrast sensitivity and stabilizes the visual acuity. The changes in contrast sensitivity and visual acuity are independent of each other.***

Keywords: Clinically significant macular edema (CSME), Cystoid Macular edema (CME), Pseudophakia, Contrast Sensitivity

1. Introduction

Contrast sensitivity is an important aspect of visual function and is even more important for ordinary daily tasks than visual acuity. Contrast sensitivity function may be deteriorated to a significant level in diabetic retinopathy, especially in diabetic macular edema.[1] Diabetic macular edema is a microvascular complication of diabetes mellitus defined as retinal thickening resulting from the accumulation of fluid in the retina. When it is associated with hard exudates, both retinal damage and permanent visual loss will occur. Diabetic macular Edema is one of the major causes for moderate vision loss in diabetic patients. Peculiar susceptibility of the macula to a number of pathological process both local and generalized is called' exaggerated response' of the macula.[2] Laser photocoagulation is the treatment modality for DME either focal or grid laser is done which reduces the edema thus improving the vision and contrast sensitivity. The objective of this study was to determine the impact of macular laser photocoagulation as the standard treatment of clinically significant macular edema on contrast sensitivity.

DME is best detected by slit lamp bio microscopy with + 90 D, 78D, or macular contact lens. Fundus fluoresce in angiography is standard method used to evaluate patients with DME that is sensitive for qualitative detection of fluid leakage. OCT aids in quantification of retinal thickening and for classification. OCT has its role in diagnosis and quantification of retinal thickening, macular volume, retinal morphology and vitreo retinal relationship in DME. It is also important in defining the indication of surgery, determining the prognosis and quantifying the response to therapy. The main pathology in DME is accumulation of fluid intraretinally. This is seen as reduced backscattering seen most in the Outer retinal layers

2. Materials and Methods

This study was intended to evaluate the efficacy of grid laser photo coagulation on contrast sensitivity in patients with CSME which was carried out in the Department of Ophthalmology Chalmeda institute of medical sciences, Karimnagar from June 2010to June 2021. Detailed history was taken from all the patients regarding the duration and treatment for Diabetes. Contrast sensitivity is recorded with Pelli-Robson chart. Visual acuity recorded with ETDRS chart. IntraOcular Pressure is measured by applanation tonometry. Anterior segment examination with slit lamp bio microscopy was done. Posterior segment examination with 90 D, binocular indirect ophthalmoscope. Optical coherence topography (OCT) was done for all patients. These patients are treated with grid laser and followed up over 3 months Grid laser done for patients with diffuse macular edema using double frequency Nd YAG laser532nm.

The parameters of grid laser are:
Duration- 100- 200ms
Spot size- 50 – 100 u
Intensity-mild to moderate
One burn width apart,500u from centre of macula and 500u from temporal margin of disc.

Guidelines for Follow up:
Patients were followed up over a period of 4 weeks, 8 weeks, 12weeks for improvement in contrast sensitivity with pelli-robson chart, visual acuity by ETDRS chart during

follow up. Quantitative analysis of macula thickness was documented by OCT.

Inclusion Criteria

1) Patients with Non-Proliferative Diabetic Retinopathy with Clinically significant macular odema (CSME)
2) Visual acuity 6/24 or better

Exclusion Criteria

1) Pseudophakia
2) Age related macular degeneration
3) Glaucoma
4) Proliferative diabetic retinopathy
5) Post pan retinal photocoagulation
6) Ischemic maculopathy

Guidelines for Follow up:

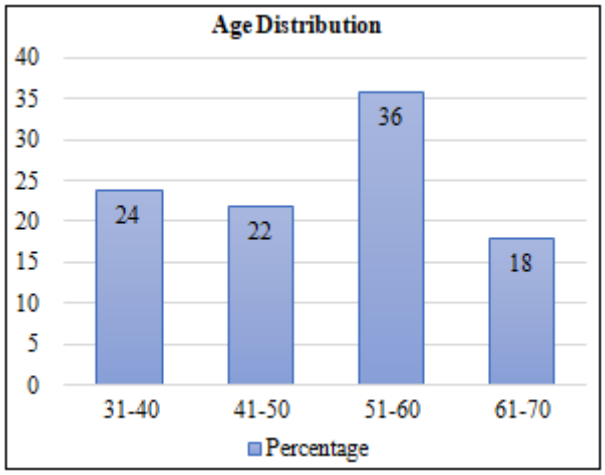
Patients were followed up over a period of 4 weeks, 8 weeks, 12 weeks for improvement in contrast sensitivity with pellirobson chart, visual acuity by ETDRS chart during follow up. Quantitative analysis of macula thickness was documented by OCT.

3. Results

In this study, 100 eyes of 50 subjects were examined to assess the improvement in contrast sensitivity with Pelli Robson chart after grid laser, to quantify assessment of macular thickness by OCT, to assess the improvement in visual acuity with ETDRS chart after grid laser.

Table 1: Age distribution

Age Distribution	No: of Patients	Percentage
31-40	12	24%
41-50	11	22%
51-60	18	36%
61-70	9	18%



Most of the patients in our study were in the age group of 51-60 (36%)

Table 2: Sex distribution

Sex Distribution	No: of Patients	Percentage
Male	58	58%
Female	42	42%

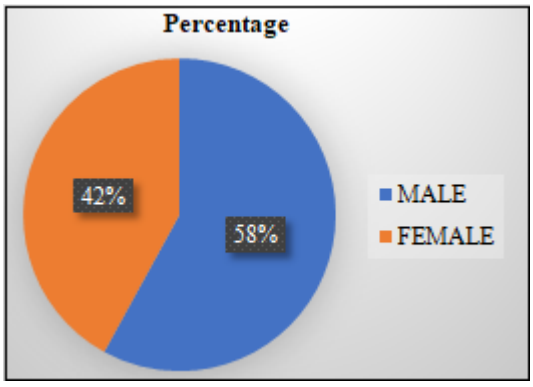
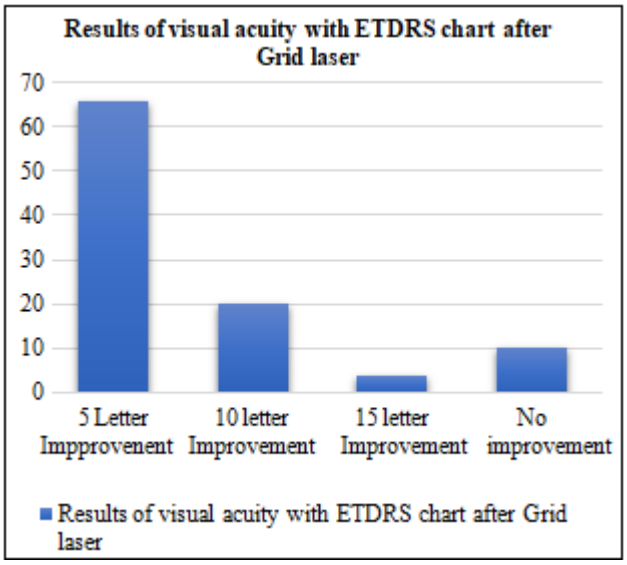


Table 3: Results of visual acuity by ETDRS chart (after 3 months)

No of letters improved on ETDRS chart	ETDRS Score = no of letters read plus 30 at distance of 4m	Eyes
5 letters	Score from 40 to 45	10
	Score from 45 to 50	22
	Score from 50 to 55	22
	Score from 55 to 60	10
	Score from 60 to 65	2
10 letters	Score from 45 to 55	14
	Score from 50 to 65	6
15 letters	Score from 50 to 65	4
No improvement	Score from 45 to 45	8
	Score from 50 to 50	2



ETDRS Score is a letter score is calculated based on the number of letters that can be correctly identified from specified distances. Higher letter scores correspond to better visual acuity. Lower letter scores mean poorer visual acuity. [3]

Table 4: Results of visual acuity by ETDRS chart (after 3months)

Results	Eyes
Improvement	90
5 letters	66
10 letters	20
15 letters	4
No Improvement	10

There was improvement in 90 eyes in the treated eyes, whereas10 eyes did not show any improvement. With 66% showing 5 letters improvement, 20% showing 5 letters improvement, 4% shows 15 letters improvement after 12 weeks of grid laser. By chi- square test P value was <0.0001 which was statistically significant

Table 5: Results of Improvement of Contrast sensitivity in Pelli Robson chart

Improvement assessed by % loss of contrast sensitivity	Eyes
From 30% loss to 20%	2
From 20% loss to 10%	22
From 10% loss to 5%	38
From 5% loss to 1%	8

Table 6: Results of Contrast sensitivity

Results	Eyes
Improvement	70
No Improvement	30

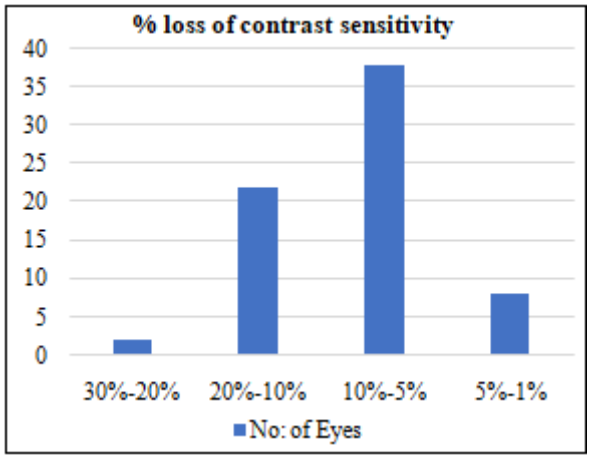
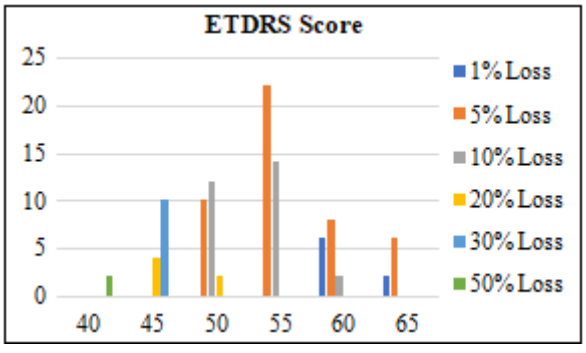


Table 7: Correlation of contrast sensitivity with visual acuity

ETDRS Score	% loss of Contrast sensitivity						Total
	1%	5%	10%	20%	30%	50%	
40	0	0	0	0	0	2	2
45	0	0	0	4	10	0	14
50	0	10	12	2	0	0	24
55	0	22	14	0	0	0	36
60	6	8	2	0	0	0	16
65	2	6	0	0	0	0	8
Total	8	46	28	6	10	2	100



2 eyes with ETDRS score of 40 had 50% loss of contrast sensitivity, 4 eyes with score of 45 had 20% loss of contrast sensitivity, 10 eyes had 50% loss of contrast sensitivity. 10 eyes with score of 50 had 5% loss of contrast sensitivity and 12 eyes had 10% loss of contrast sensitivity. 8 eyes with score of 60 had 5% loss of contrast sensitivity. The chi-square test had P value < 0.0001 which was statistically significant.

Table 8: OCT findings in patients

OCT Findings	Eyes
CYSTOID Odema	28
SPONGY Odema	48
SUBFOVEAL Detachment	16

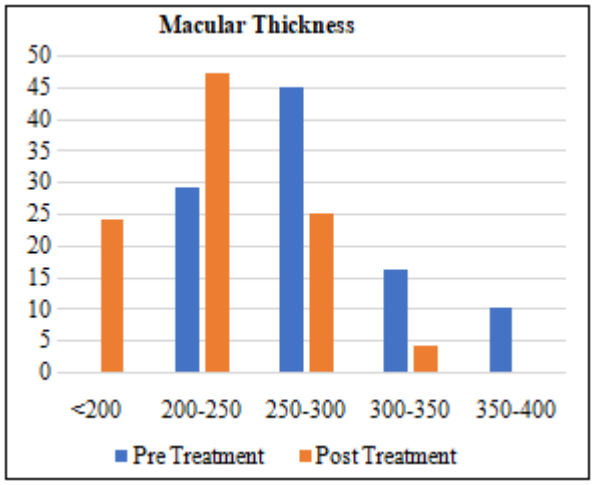
Spongy Oedema is confined mostly in outer retinal layers while internal layers maintain their normal reflectivity.[5] Most of the patients in our study included spongy type of macular oedema (48 eyes), cystoid oedema in 28 eyes, sub foveal detachment in16 eyes.

Table 9: Pre-treatment macular thickness

Macular Thickness (microns)	Eyes
200-250	25
250-300	45
300-350	16
350-400	10

Table 10: Post treatment macular thickness

Macular Thickness (microns)	Eyes
<200	24
200-250	47
250-300	25
300-350	4



Macular thickness showed significant improvement. Prior to treatment 71 % patients had thickness more than 250 microns Post treatment all patients had macular thickness less than 350 microns.

However reduction in macular thickness didn't correspond to an equivalent increase in visual acuity and contrast sensitivity to long standing macular oedema which leads to photoreceptor

By chi-square test P value was < 0.0001 which was statistically significant.

4. Discussion

This study was conducted at Department of Ophthalmology, Chalmeda Ananda Rao Institute of Medical Sciences from June 2019 to June 2021. 50 patients fulfilling the inclusion and exclusion criteria were included in the study. Most of the patient in our study was in the age group of 51-60yrs (36%). In our study male patients were 58 % and remaining 42% being females. There was improvement in 90 eyes in the treated eyes, whereas 10 eyes did not show any improvement. With 66% showing 5 letters improvement, 20% showing 5 letters improvement, 4% showing 15 letters improvement aft 12 weeks of grid laser. As per ETDRS study there was reduction in the moderate visual loss. By chi- square test P value was < 0.0001 which was statistically significant. Contrast sensitivity is more important and disturbing for the patient than is the loss of visual acuity. [4] In our study there was improvement in contrast sensitivity in 70 eyes. And 30 eyes didn't show improvement. By chi-square test P value was < 0.0001which was statistically significant. Contrast sensitivity can be impaired even in the presence of normal visual acuity. As per study visual acuity with 6/24 or better only were included in the study. 2 eyes with ETDRS score of 40 had 50% loss of contrast sensitivity, 4 eyes with score of 45 had 20% loss of contrast sensitivity, 10 eyes had 50% loss of contrast sensitivity. 10 eyes with score of 50 had 5% loss of contrast sensitivity and 12 eyes had 10% loss of contrast sensitivity. 8 eyes with score of 60 had 5% loss of contrast sensitivity. There is no significant association between visual acuity and Contrast sensitivity.

Macular thickness in OCT

Macular thickness showed significant improvement. Prior to treatment 71 % patients had thickness more than 250 microns. Post treatment all patients had macular thickness less than 350 microns. However, reduction in macular thickness didn't correspond to an equivalent increase in visual acuity and contrast sensitivity could be due to long standing macular edema which leads to photoreceptor damage

5. Conclusion

Contrast sensitivity is an important aspect of visual function and is even more important for ordinary daily tasks than visual acuity. Loss of Contrast sensitivity is more important and disturbing for the patient than is the loss of visual acuity. Visual acuity was recorded by ETDRS chart due to the fallacies associated in Snellen chart. [6]The Contrast sensitivity was recorded by Pelli Robson's chart was sensitive and reproducible. Grid laser photocoagulation in CSME helps in improving the contrast sensitivity and stabilizes the visual acuity. The changes in contrast sensitivity and visual acuity are independent of each other.

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